Booting Linux x86 and x86_64 systems from a Storage Area Network with Device Mapper Multipath

Enabling the High Availability feature for Operating System Partitions
Fifth Edition

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Document Overview

This white paper helps you understand the concepts and configuration of boot from SAN and enabling multipath features for the Root partition on SAN in deployments using Device Mapper multi-path. It includes recommendations for implementing and configuring operating system installation partitions to enable the Device Mapper multipath feature on your Linux server.

Intended Audience

This document is intended for users who would be implementing the high availability features of Boot-from-SAN and Root partition for the Linux operating system with Device Mapper multipath.

Assumptions

This document assumes that the user is familiar with the following:

- HP Fibre Channel Host Bus Adapters (HBAs) for Linux servers
- HP SAS Host Bus Adapters
- HP Smart Array Controllers
- HP StorageWorks Disk arrays
- Device Mapper multipath solution
- HP ProLiant servers
- HP ProLiant Gigabit Ethernet Multifunction server adapter

Introduction

Traditionally, servers were configured to install the operating system on internal direct attached storage device (local disk). With advances in storage technologies, and the need for storage and server consolidation, there is a need to enable booting from the Storage Area Network (SAN) and providing high availability features for the operating system.

The high availability feature for the Boot device on SAN during the boot process is provided by configuring the HBA BIOS with redundant boot paths. Many vendors refer to this feature as Boot from SAN (BFS). For more information, see "Configuring Boot from SAN".

Linux operating system vendors have incorporated the multipathing feature for the operating system installation partitions. For more information, see "Installing the operating system".

Supported Configuration

Device Mapper Multipath supports Boot-from-SAN operations on ProLiant and HP Integrity servers. This functionality is specifically HBA/BIOS centric. For BFS-supported HP StorageWorks disk arrays and HBAs, see Single Point of Connectivity Knowledge (SPOCK) at: http://www.hp.com/storage/spock. You must sign up for a HP Passport to enable access.

High availability on installation partitions is supported by the following operating systems:

- Red Hat distribution - RHEL 5 Update 2 and above
- Novell distribution - SLES 10 SP2 and above
  SLES 11 and above

Note: It is recommend to have separate devices for the /boot and root (/) partitions.
Enabling multipath features for the Installation partitions on SAN with HP Smart Array p700m controller is supported only on SLES 10 SP2/SLES 11 operating system and above. Refer to the product release documents for latest updates.

Configuring boot from SAN

Boot from SAN has become a de facto description for the capability of having a server boot its operating system from SAN. The HBA ROM provides this functionality. Once HBAs are configured to boot from the disk device on the SAN, the server boots as if it were a local disk.

More than one HBA can be configured for the redundant boot path for the High Availability of the Boot device. The Failover feature during boot time is provided by the HBA ROM configuration.

Note: Device Mapper Multipathing features are available after the kernel loads the multipathing modules from the initial RAM disk image.

Configuring the HBA/NIC ROM for High Availability of Boot device

To set up your Linux server to boot from a SAN device, complete the following steps:

Setting up the storage arrays

1. Create two Logical units for Boot and Root devices
2. Present the Logical units to the Linux server

Note: For more information on configuring the Logical units, refer to the HP StorageWorks array User Guide.

Setting up the host systems

To configure the host boot order for HP ProLiant servers with Multifunctional Gigabit Ethernet Server Adapter, complete the following steps:

1. While the system is booting, press F9 to start the BIOS Setup Utility.
2. Select Boot Controller Order.
    1. Select the HBA configured to provide the boot device and move it to Controller Order 1.
    2. In case of multiple HBAs, set to the higher Controller Order.
3. Press Escape, and press F10 to save your configuration and exit the utility.

To enable the iSCSI boot option ROM for HP ProLiant Gigabit Ethernet Multifunction server adapter in your server, complete the following steps:

1. While the system is booting, press F9 to start the BIOS Setup Utility.
2. Select *System Options*.

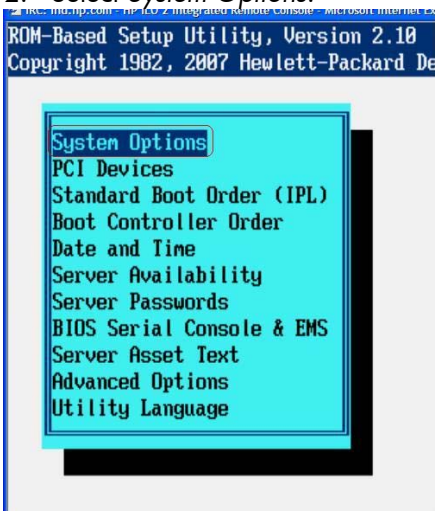

Figure 1

    a. Select *Embedded NICs*.

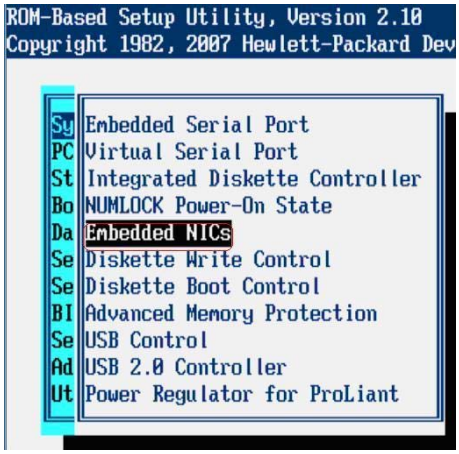
ROM-Based Setup Utility, Version 2.10
Copyright 1982, 2007 Hewlett-Packard Dev
Sy Embedded Serial Port
PC Virtual Serial Port
St Integrated Diskette Controller
Bo NUMLOCK Power-On State
Da Embedded NICs
Se Diskette Write Control
Se Diskette Boot Control
BI Advanced Memory Protection
Se USB Control
Ad USB 2.0 Controller
Ut Power Regulator for ProLiant

Figure 2

b. Select the NIC to which the boot option is to be set and press Enter twice.

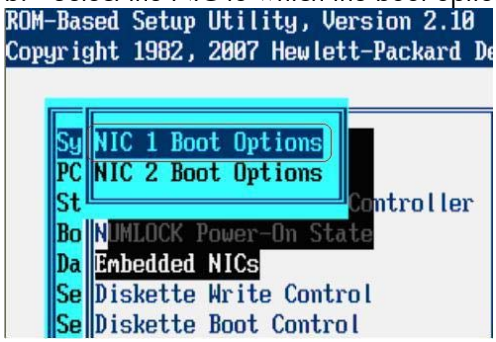
ROM-Based Setup Utility, Version 2.10
Copyright 1982, 2007 Hewlett-Packard De
Sy NIC 1 Boot Options
PC NIC 2 Boot Options
St
Bo NUMLOCK Power-On State
Da Embedded NICs
Se Diskette Write Control
Se Diskette Boot Control

Figure 3

c. Select *iSCSI Boot* and press Enter.

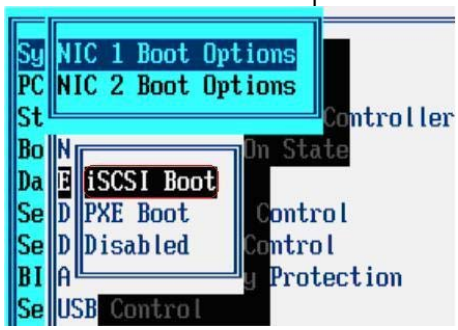

Figure 4

d. iSCSI Boot must be displayed as the boot option for the NIC you selected.

Figure 5

3. Press Escape, and then press F10 to save your configuration and exit the utility.

Configuring HBA/NIC ROM

This section details the steps to configure the Host Bus Adapter to boot from SAN.

Qlogic HBA ROM configuration

Emulex HBA ROM configuration

HP Smart Array P700m Controller ORCA configuration

HP SC08Ge SAS HBA configuration

HP ProLiant Gigabit Ethernet Multifunction server adapter configuration

Qlogic HBA ROM configuration

To configure the boot device for high availability on HP ProLiant servers, complete the following steps:

1. While the server is booting, press Ctrl+Q to enter *Fast!UTIL*.
2. From the *Select Host Adapter* menu, select the HBA you want to boot, and press Enter.

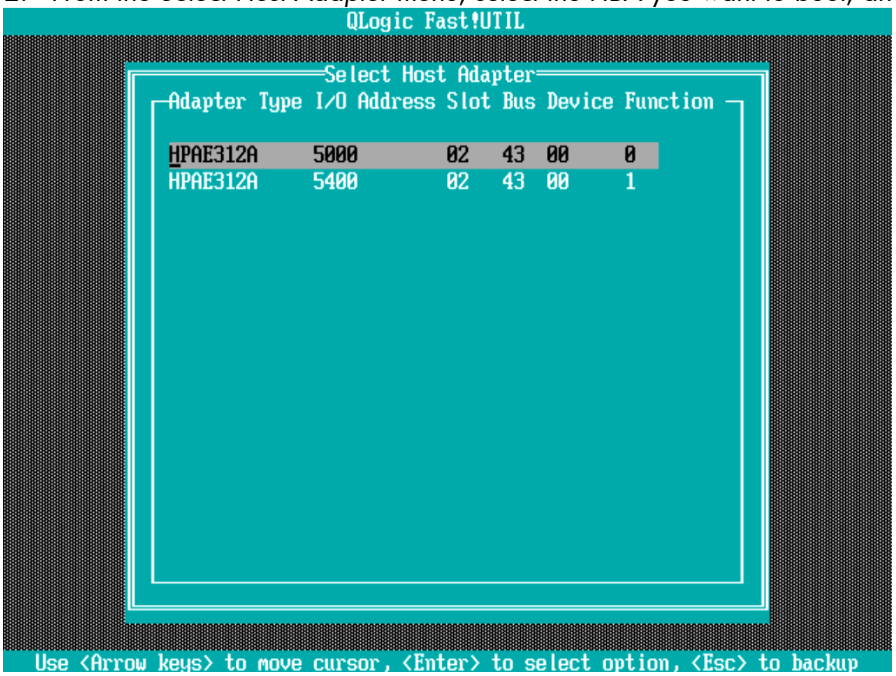

Figure 6

3. From the *Fast!UTIL Options* menu, select *Configuration Settings*, and press Enter.

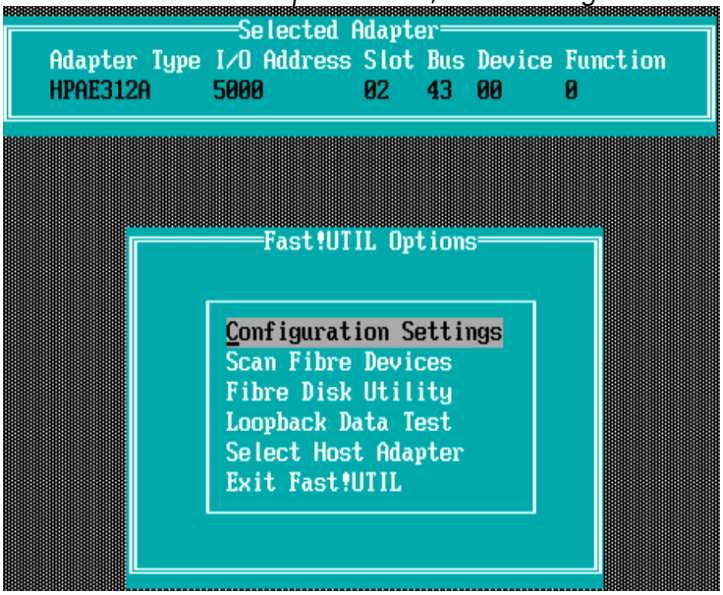

Figure 7

4. From the *Configuration Settings* menu, select *Adapter Settings*, and press Enter.

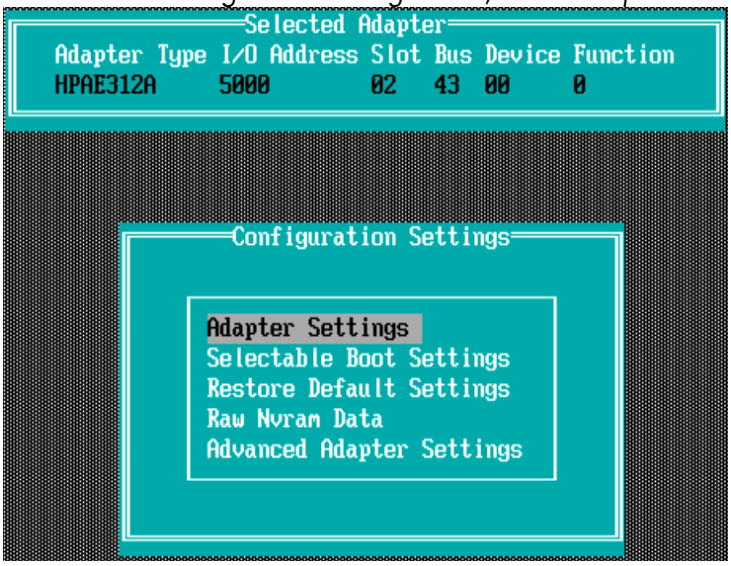

Figure 8

5. From the *Adapter Settings* menu, change Host Adapter BIOS to *Enabled* by pressing Enter.

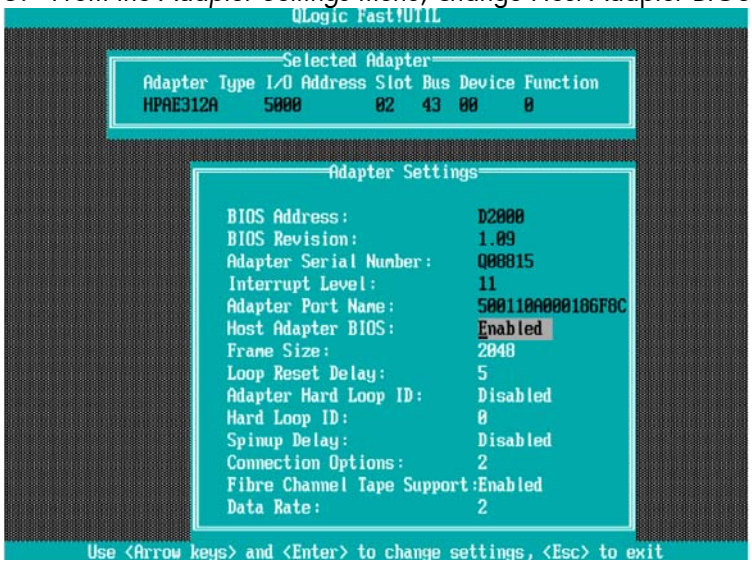

Figure 9

6. Press ESC to go back to the *Configuration Settings* menu Figure 8.
7. Select *Selectable Boot Settings*, and then press Enter.
8. From the *Selectable Boot Settings* menu, enable the Selectable Boot option by pressing Enter, move the cursor to Primary Boot Port Name, LUN, and press Enter.

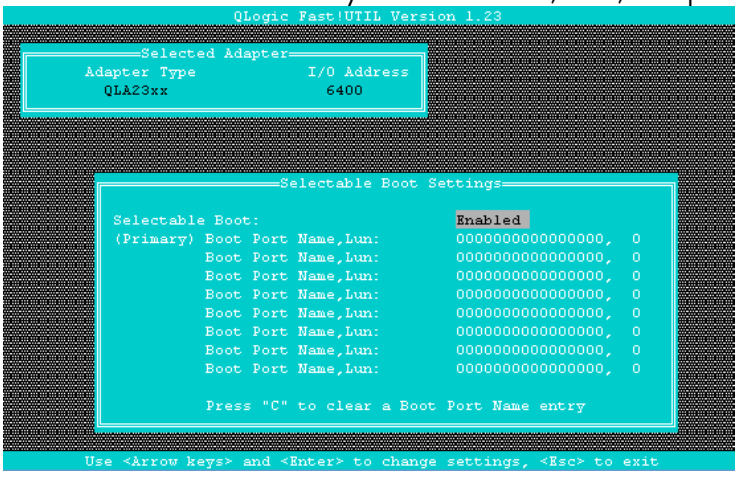
QLogic Fast!UTIL Version 1.23
Selected Adapter
Adapter Type I/O Address
QLA23xx 6400
Selectable Boot Settings
Selectable Boot: Enabled
(Primary) Boot Port Name,Lun: 0000000000000000, 0
Boot Port Name,Lun: 0000000000000000, 0
Boot Port Name,Lun: 0000000000000000, 0
Boot Port Name,Lun: 0000000000000000, 0
Boot Port Name,Lun: 0000000000000000, 0
Boot Port Name,Lun: 0000000000000000, 0
Boot Port Name,Lun: 0000000000000000, 0
Boot Port Name,Lun: 0000000000000000, 0
Press "C" to clear a Boot Port Name entry
Use <Arrow keys> and <Enter> to change settings, <Esc> to exit

Figure 10

9. From the *Select Fibre Channel Device* menu, select the controller Port Name of the array and press Enter.

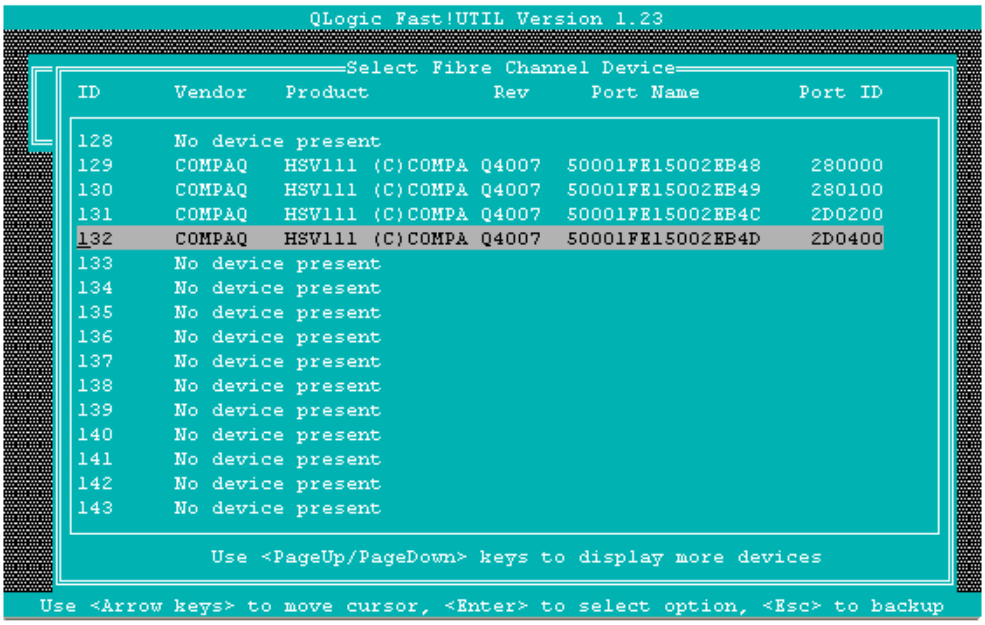
QLogic Fast!UTIL Version 1.23
Select Fibre Channel Device
ID Vendor Product Rev Port Name Port ID
128 No device present
129 COMPAQ HSV111 (C)COMPA Q4007 50001FE15002EB48 280000
130 COMPAQ HSV111 (C)COMPA Q4007 50001FE15002EB49 280100
131 COMPAQ HSV111 (C)COMPA Q4007 50001FE15002EB4C 2D0200
132 COMPAQ HSV111 (C)COMPA Q4007 50001FE15002EB4D 2D0400
133 No device present
134 No device present
135 No device present
136 No device present
137 No device present
138 No device present
139 No device present
140 No device present
141 No device present
142 No device present
143 No device present
Use <PageUp/PageDown> keys to display more devices
Use <Arrow keys> to move cursor, <Enter> to select option, <Esc> to backup

Figure 11

10. From *Select LUN* menu, select the device to boot from, and press Enter.

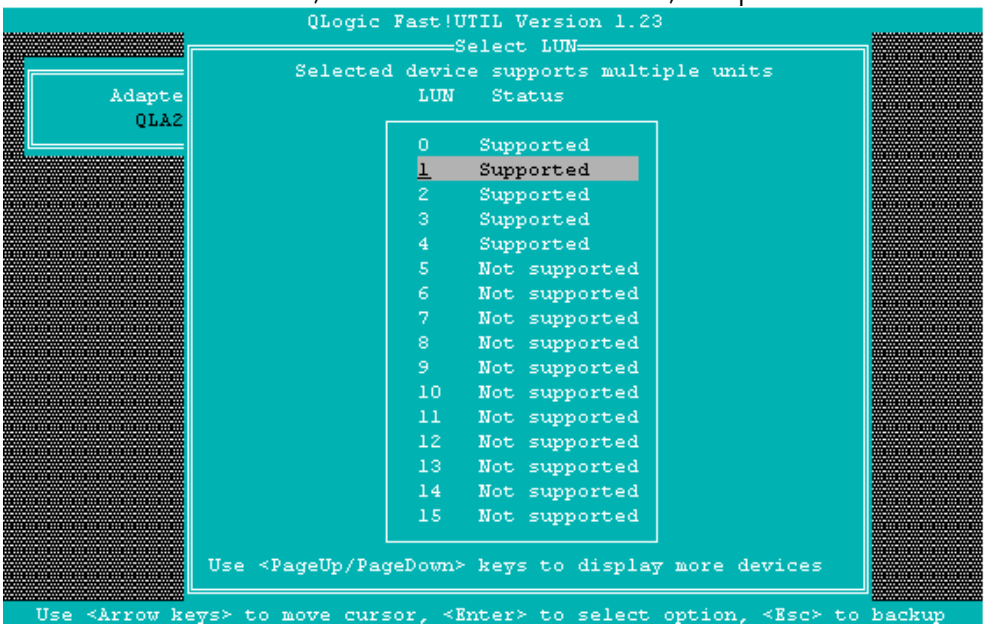

Figure 12

Note: LUN index in the previous figure corresponds to the Lun ID of the boot device presented to the host.

11. From the *Selectable Boot Settings* menu, to configure the secondary boot paths, select Boot Port Name, Lun. Repeat Step 8 and Step 9 for all the other controller ports of the array.

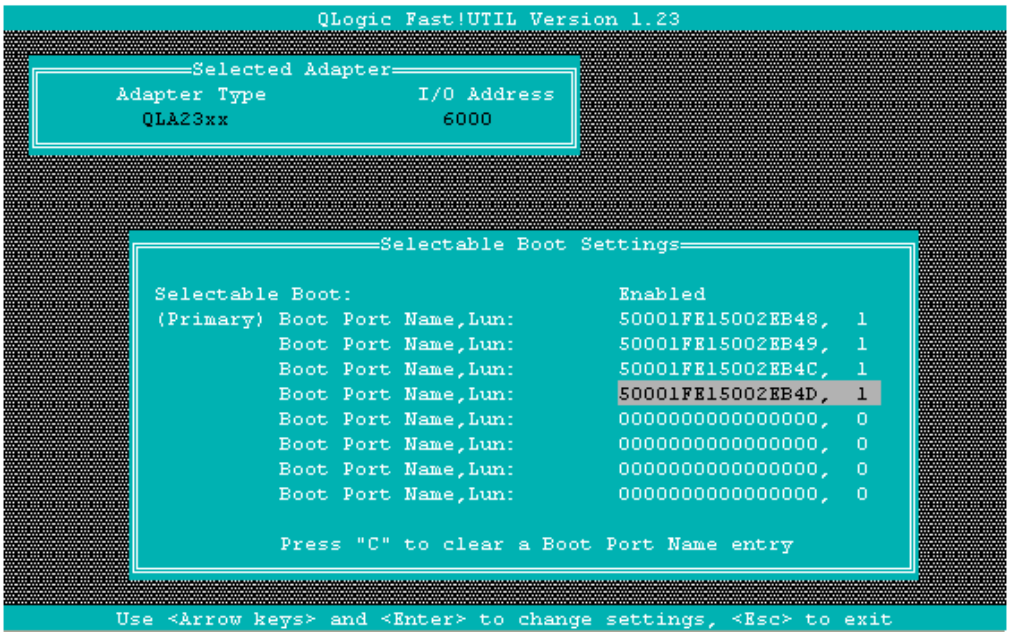

Figure 13

12. Save the changes by pressing ESC twice, and then select Save Changes. This saves the configuration changes to selected HBA.
13. From the *Fast!UTIL Options* menu, choose Select Host Adaptor option, and press Enter. Select the other HBAs (Figure 6) and repeat the steps 2 to 12 to configure the HBA for booting the server.

Note: Refer to the "Booting Itanium Linux systems from a storage area network application notes" for the procedure to configure the HBA ROM on an Itanium server. You can locate this guide in the SPOCK website (http://www.hp.com/storage/spock) under Boot Guide Application Notes. You must sign up for a HP Passport to enable access.

Emulex HBA ROM configuration

To configure the boot device for high availability on HP ProLiant servers, complete the following steps:

1. While the server is booting, press Alt+E when the following message appears: **Press <Alt E> To Go To Emulex BIOS Utility**.
2. The Emulex BIOS utility displays *Emulex Adapters* in the system. At the *Enter a Selection* prompt, select the HBA index number.

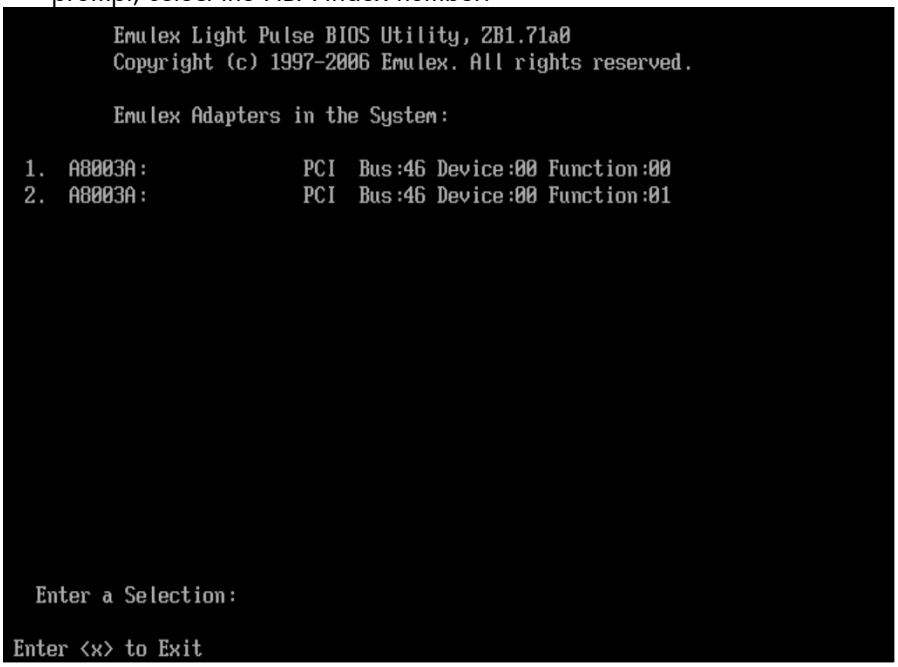
Emulex Light Pulse BIOS Utility, ZB1.71a0
Copyright (c) 1997-2006 Emulex. All rights reserved.
Emulex Adapters in the System:
1. A8003A: PCI Bus:46 Device:00 Function:00
2. A8003A: PCI Bus:46 Device:00 Function:01
Enter a Selection:
Enter <x> to Exit

Figure 14

3. From the HBA *configuration menu* screen, select option 2, Configure This Adapter's Parameters.

Port Name: 10000000 C964621E Node Name: 20000000 C964621E
Topology: Auto Topology: Loop First (Default)
The BIOS of this Adapter is Disable
1. Configure Boot Devices
2. Configure This Adapter's Parameters
Enter a Selection:
Enter <x> to Exit <d> to Default Values <Esc> to Previous Menu

Figure 15

4. From *Configure Adapter's Parameters* screen, select option 1, *Enable or Disable BIOS*. Press 1 to enable the BIOS; press Esc to return to the main menu.

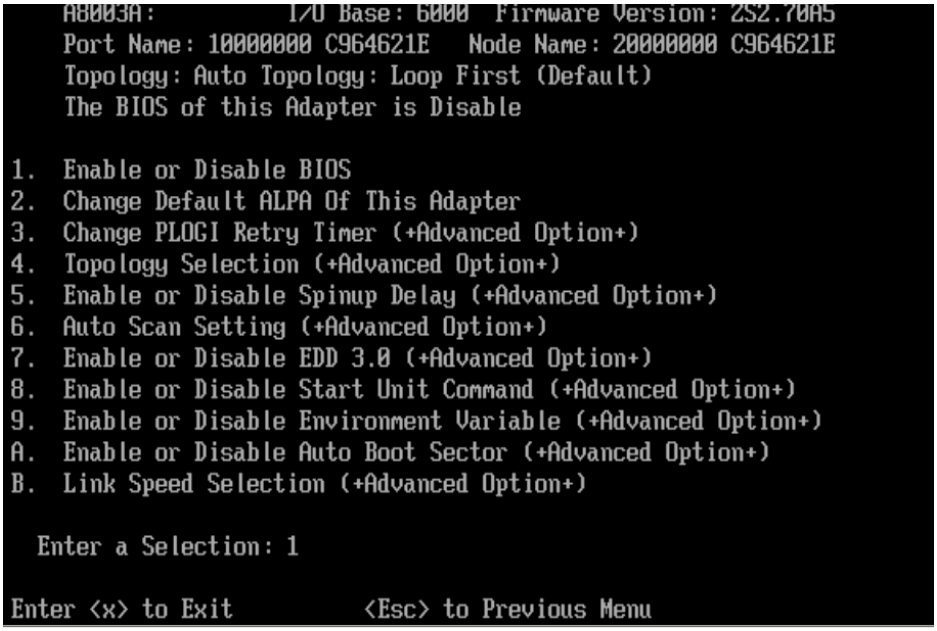
A8003A: I/O Base: 6000 Firmware Version: 2.72.70A5
Port Name: 10000000 C964621E Node Name: 20000000 C964621E
Topology: Auto Topology: Loop First (Default)
The BIOS of this Adapter is Disable
1. Enable or Disable BIOS
2. Change Default ALPA Of This Adapter
3. Change PLOGI Retry Timer (+Advanced Option+)
4. Topology Selection (+Advanced Option+)
5. Enable or Disable Spinup Delay (+Advanced Option+)
6. Auto Scan Setting (+Advanced Option+)
7. Enable or Disable EDD 3.0 (+Advanced Option+)
8. Enable or Disable Start Unit Command (+Advanced Option+)
9. Enable or Disable Environment Variable (+Advanced Option+)
A. Enable or Disable Auto Boot Sector (+Advanced Option+)
B. Link Speed Selection (+Advanced Option+)
Enter a Selection: 1
Enter <x> to Exit
<Esc> to Previous Menu

Figure 16

5. From the *Configure Adapter's Parameters* screen (Figure 16) select option 4, Topology Selection, (Advanced Option).
6. From the *Topology Selection* menu, select option 4, Fabric Point to Point. Press Esc twice.
7. From the *HBA configuration menu* (), select option 1, Configure Boot Devices.
8. In the *Saved Boot Devices* list, select 1 as the primary boot path.

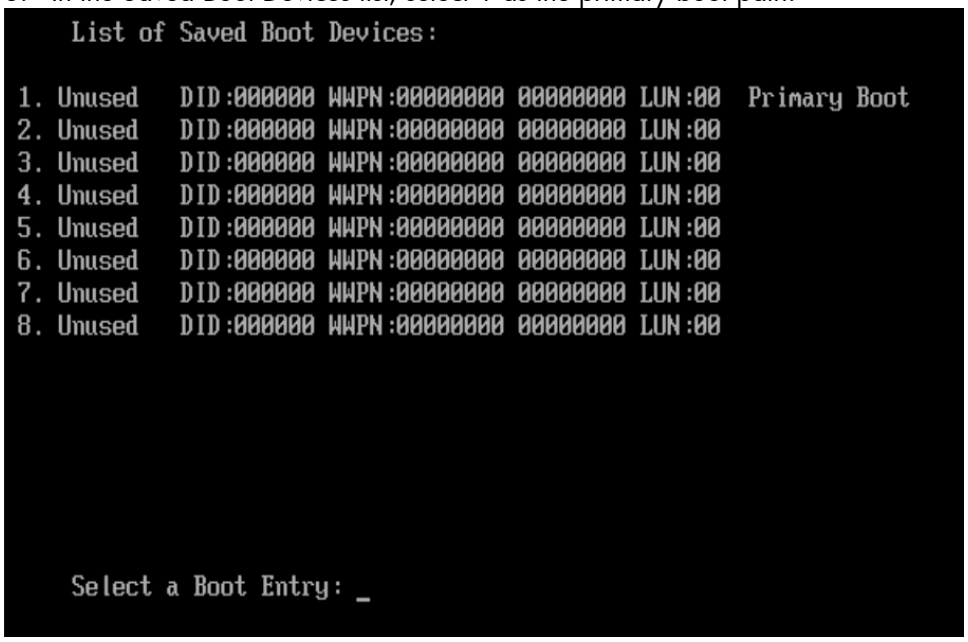

Figure 17

9. At the *Select Two-Digit Number of the Desired Boot Device* prompt, enter the index of the desired controller port.

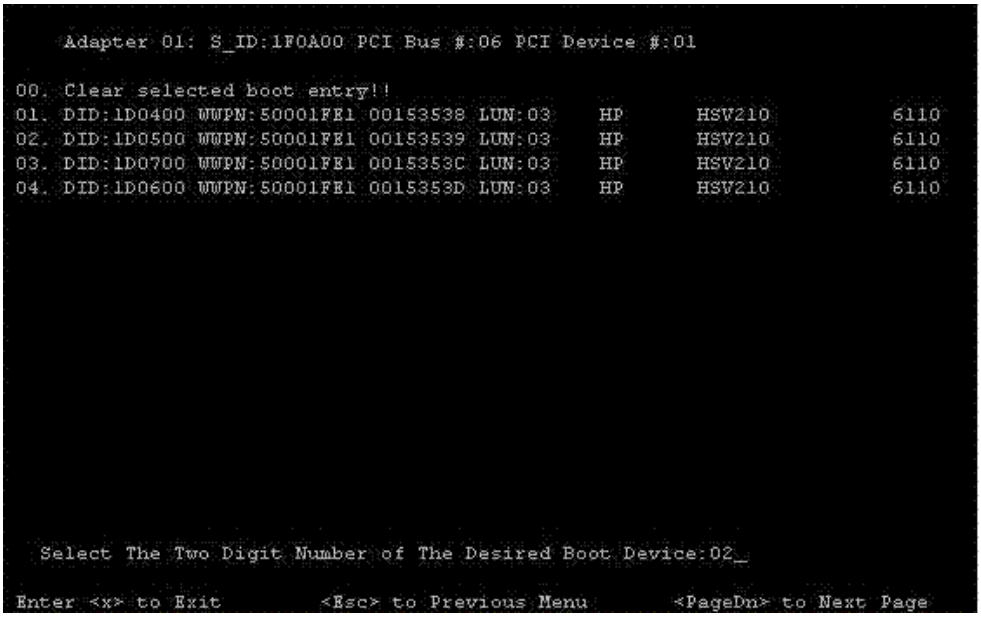
Adapter 01: S_ID:1F0A00 PCI Bus #:06 PCI Device #:01
00. Clear selected boot entry!!
01. DID:1D0400 WWPN:50001FE1 00153538 LUN:03 HP HSV210 6110
02. DID:1D0500 WWPN:50001FE1 00153539 LUN:03 HP HSV210 6110
03. DID:1D0700 WWPN:50001FE1 0015353C LUN:03 HP HSV210 6110
04. DID:1D0600 WWPN:50001FE1 0015353D LUN:03 HP HSV210 6110
Select The Two Digit Number of The Desired Boot Device:02_
Enter <x> to Exit <Esc> to Previous Menu <PageDn> to Next Page

Figure 18

10. Enter the LUN ID of the starting LUN at the prompt. The devices are scanned starting from the entered LUN ID.

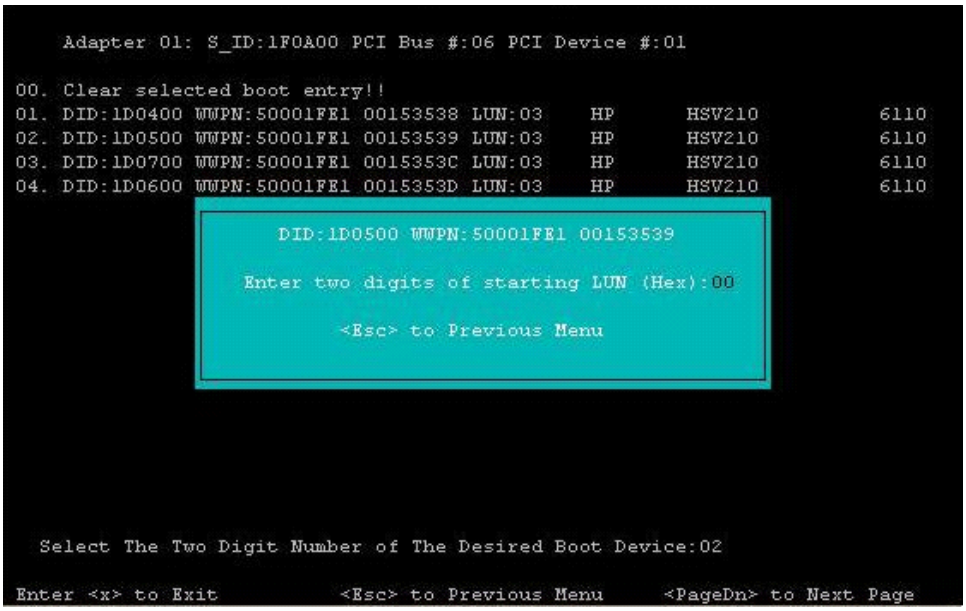
Adapter 01: S_ID:1F0A00 PCI Bus #:06 PCI Device #:01
00. Clear selected boot entry!!
01. DID:1D0400 WWPN:50001FE1 00153538 LUN:03 HP HSV210 6110
02. DID:1D0500 WWPN:50001FE1 00153539 LUN:03 HP HSV210 6110
03. DID:1D0700 WWPN:50001FE1 0015353C LUN:03 HP HSV210 6110
04. DID:1D0600 WWPN:50001FE1 0015353D LUN:03 HP HSV210 6110
DID:1D0500 WWPN:50001FE1 00153539
Enter two digits of starting LUN (Hex):00
<Esc> to Previous Menu
Select The Two Digit Number of The Desired Boot Device:02
Enter <x> to Exit <Esc> to Previous Menu <PageDn> to Next Page

Figure 19

11. At the prompt, enter the index of the Boot device from the list.

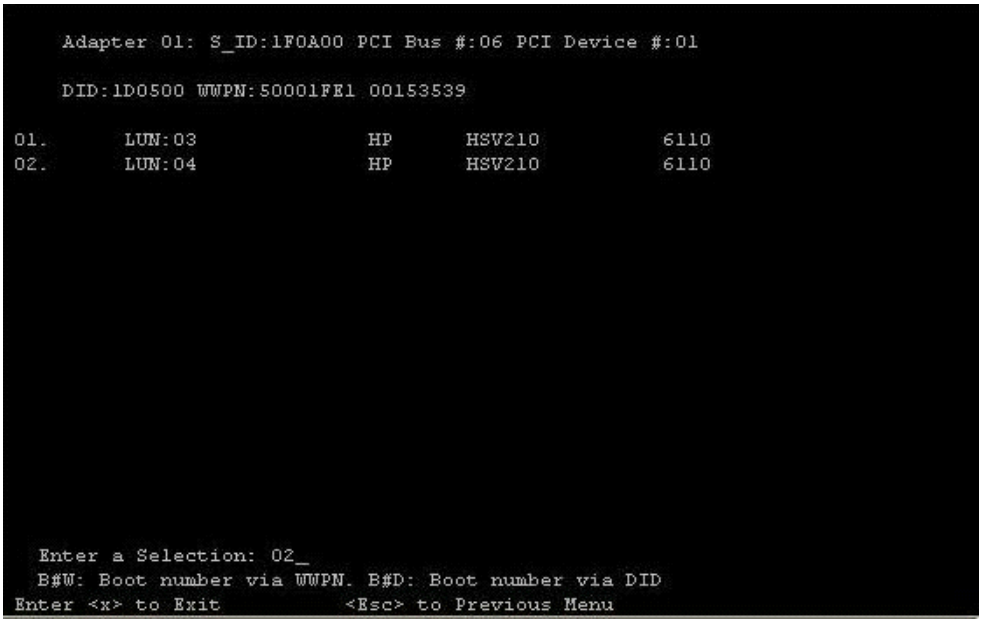
Adapter 01: S_ID:1F0A00 PCI Bus #:06 PCI Device #:01
DID:1D0500 WWPN:50001FE1 00153539
01. LUN:03 HP HSV210 6110
02. LUN:04 HP HSV210 6110
Enter a Selection: 02_
B#W: Boot number via WWPN. B#D: Boot number via DID
Enter <x> to Exit <Esc> to Previous Menu

Figure 20

12. Select option 1, *Boot this device via WWPN*.

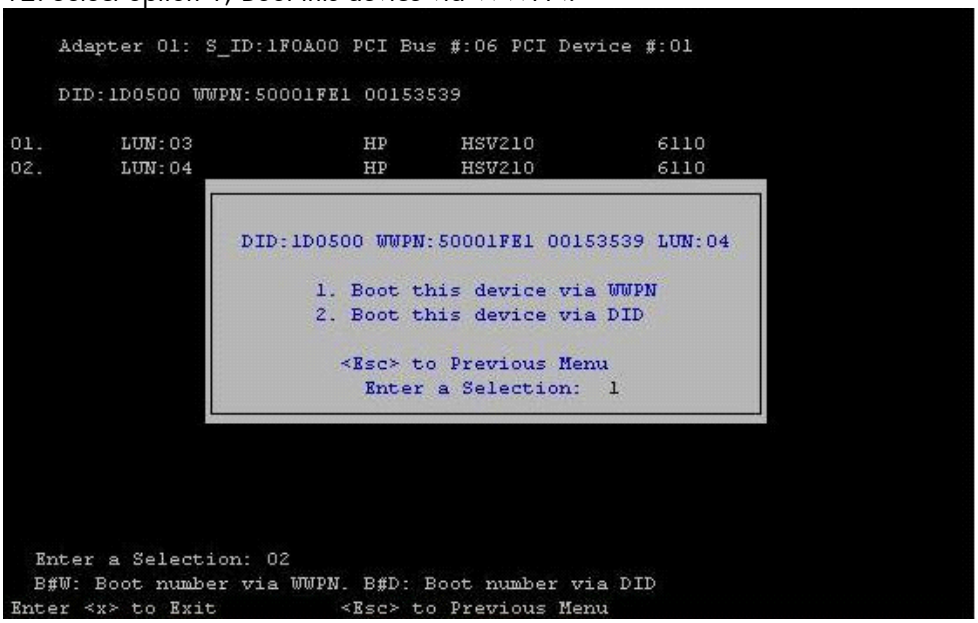
Adapter 01: S_ID:1F0A00 PCI Bus #:06 PCI Device #:01
DID:1D0500 WWPN:50001FE1 00153539
01. LUN:03 HP HSV210 6110
02. LUN:04 HP HSV210 6110
DID:1D0500 WWPN:50001FE1 00153539 LUN:04
1. Boot this device via WWPN
2. Boot this device via DID
<Esc> to Previous Menu
Enter a Selection: 1
Enter a Selection: 02
B#W: Boot number via WWPN. B#D: Boot number via DID
Enter <x> to Exit <Esc> to Previous Menu

Figure 21

13. From the *Saved device list menu* (Figure17), configure the alternate paths for boot devices by selecting the unused entries and repeating steps 9 to 12.
14. From *Emulex Adapters* menu (Figure 14), configure the other HBAs by repeating steps 2 to 13.
15. Exit from the BIOS menu and reboot the server.

Note: Refer to the "HP StorageWorks Booting Itanium Linux systems from a storage area network application notes" for the procedure to configure the Emulex HBA ROM on Integrity server.

To configure the boot device for high availability on HP ProLiant servers, complete the following steps:

1. While the server is booting, press F8 when the HP Smart Array P700m controller is discovered, to go to Option Rom Configuration for Arrays (ORCA).
2. At the *Main Menu* of the ORCA utility, select *Select Boot Volume* and press Enter.

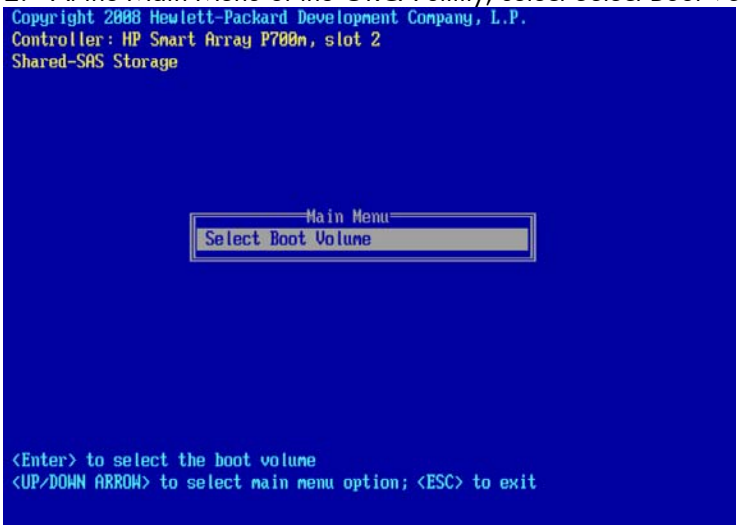

Figure 22

3. At *Boot Volume Enclosure Menu*, select External and press Enter.

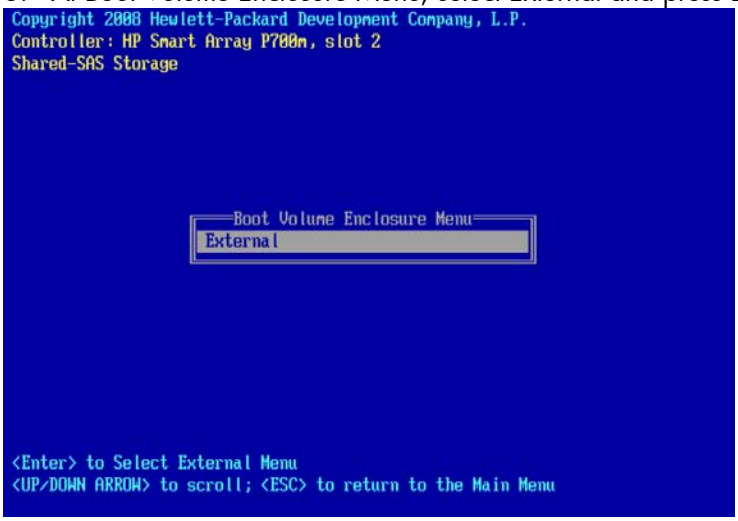

Figure 23

4. At *External Boot Volume Menu*, select the controller port WWID for the boot path.

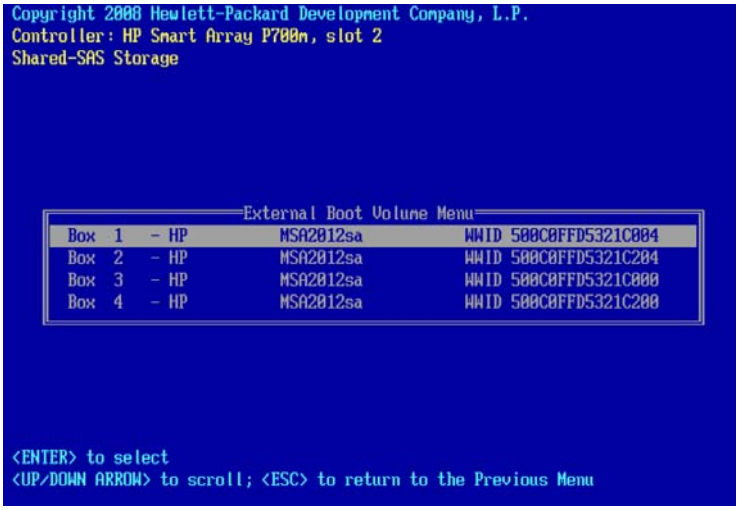
Copyright 2008 Hewlett-Packard Development Company, L.P.
Controller: HP Smart Array P700m, slot 2
Shared-SAS Storage
External Boot Volume Menu
Box 1 - HP MSA2012sa WWID 500C0FFD5321C004
Box 2 - HP MSA2012sa WWID 500C0FFD5321C204
Box 3 - HP MSA2012sa WWID 500C0FFD5321C000
Box 4 - HP MSA2012sa WWID 500C0FFD5321C200
<ENTER> to select
<UP/DOWN ARROW> to scroll; <ESC> to return to the Previous Menu

Figure 24

5. At *Menu Select Boot Volume*, select the Lun to be configured as Boot partition.

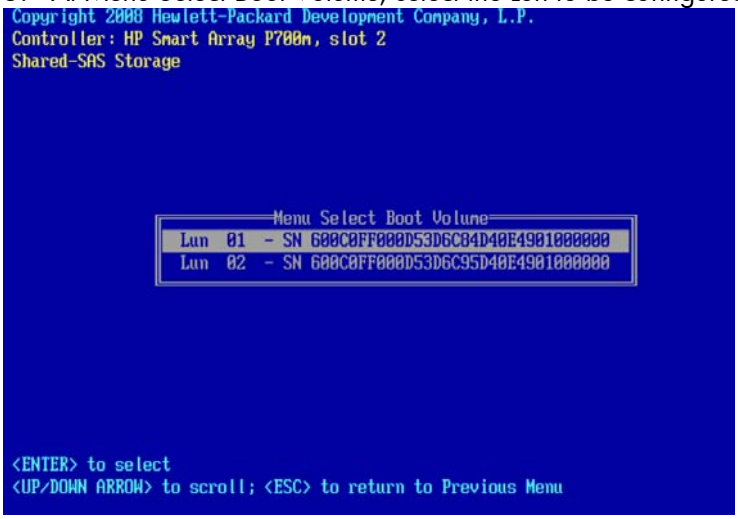
Copyright 2008 Hewlett-Packard Development Company, L.P.
Controller: HP Smart Array P700m, slot 2
Shared-SAS Storage
Menu Select Boot Volume
Lun 01 - SN 600C0FF000D53D6C84D40E4901000000
Lun 02 - SN 600C0FF000D53D6C95D40E4901000000
<ENTER> to select
<UP/DOWN ARROW> to scroll; <ESC> to return to Previous Menu

Figure 25

6. Press F8 to save as Boot Volume.

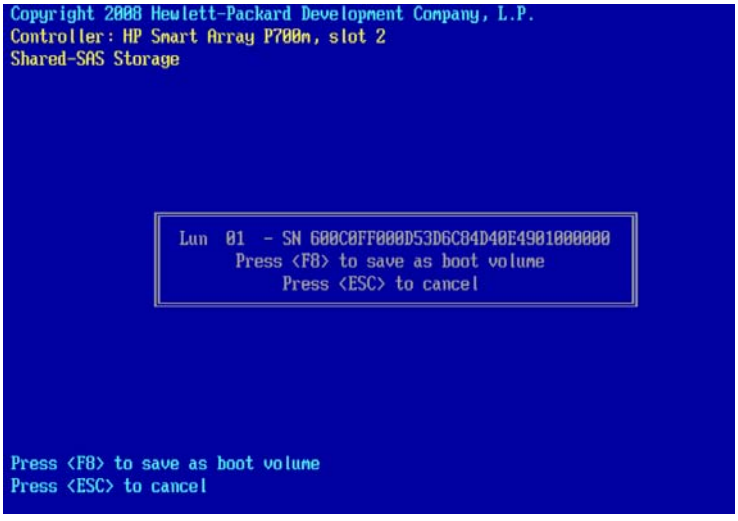
Copyright 2008 Hewlett-Packard Development Company, L.P.
Controller: HP Smart Array P700m, slot 2
Shared-SAS Storage
Lun 01 - SN 600C0FF000D53D6C84D40E4901000000
Press <F8> to save as boot volume
Press <ESC> to cancel
Press <F8> to save as boot volume
Press <ESC> to cancel

Figure 26

7. Press Enter to configure alternate paths to boot device, else go to Step 9.
8. At the *External Boot Volume Menu*, select the other controller port WWID by repeating steps 4 to 6.
9. Press ESC to exit the ORCA.

HP SC08Ge SAS HBA configuration

To configure the HP SC08Ge SAS HBA as the boot controller, complete the following steps:

1. While the system is booting, press F9 to start the ROM-Based BIOS Setup Utility.
2. Select *Boot Controller Order*.
   a. Select the *SCSI Mass Storage Controller*, configured to provide the boot device and move it to Controller Order 1.
   b. Incase of multiple HBAs, set to the next higher Controller Order.
3. Press Escape, and then press F10 to save your configuration and exit the utility.

For more information on configuring the HP SC08Ge SAS HBA, refer to http://h71028.www7.hp.com/ERC/downloads/4AA2-1683ENW.pdf

HP ProLiant Gigabit Ethernet Multifunction server adapter configuration

Upgrade to the latest iSCSI Boot Option ROM image using

- HP NC-Series Broadcom Online Firmware Upgrade Utility for Linux (CP00xxxx.scexe).

To download and use the HP NC-Series Broadcom Online Firmware Upgrade Utility for Linux (CP00xxxx.scexe), complete the following steps:

1. Go to the HP website at http://www.hp.com.
2. Click Software & Driver Downloads.
3. Enter the product name (for example, NC373i) in the product box and begin the search.
4. Select an operating system.
5. Click HP NC-Series Broadcom Online Firmware Upgrade Utility.
6. Click Download and save the CP00xxxx.scexe and CP00xxxx.txt file to a directory on your hard drive.

The SCEXE (Smart Component Executable) components are self-extracting executable file.

Updating iSCSI option ROM
HP NC-Series Broadcom Online Firmware Upgrade Utility for Linux must be used on the system that needs the iSCSI boot option ROM to be updated from a Linux opertaing system or a Linux opertaing system live CD.
To update to latest iSCSI boot option ROM image, complete the following steps:

1. The firmware utility requires the adapter interface to be up and running. Bring up a network adapter interface using the following command:
   # ifup ethx
   Or
   # ifconfig ethx up
2. Update the firmware using the following command:
   #./CPXXXXXX.scexe

The upgrade installation activity is written to a common installation log file called ./nicfwupg.log.

Setting up iSCSI boot LUN
ev utility present in the HP ProLiant iSCSI Boot Package for Linux can be downloaded from the software download page of HP ProLiant iSCSI Boot Package for Linux.

1. Create the configuration file *evinput.txt*. A sample configuration file is shown below.

Following is a sample configuration file.

```
##
# Copyright 2006 Hewlett-Packard Development Company, L.P.
# All Rights Reserved
```

```
# 06/15/06 jpd
#
# Consult the IETF iSP iSCSI for details of these items.
#
##
# Name of the iSCSI Target. Must match what the target offers.
# Hard coded Target IP .. No DNS support
#
TargetName= iqn.1986-03.abc.as:asddfrt.dsa23243
TargetIP=12.234.45.123
TargetPort=3260
TargetIP2=12.234.45.124
TargetPort2=3260
##
# local name the iSCSI client will present to the Target
# and local IP settings. No DNS or DHCP support
#
InitiatorName=iqn.1234-98.com.asfd:19.23456ghg12:name
InitiatorIP=12.234.34.543
InitiatorNetmask=255.255.255.0
InitiatorRoute=12.234.34.1

## Locally Admin Address (MAC address) and VLAN (Enabled/Disabled)
#
LAA=000000000000
VLAN=Disabled
## LUN Mapping
#
LUN=1
## Make this persistent BIOS int 13 IPL routine. Replaces Embedded HD C:\ (if present).
#.
ForceBoot=True
## Digest (CheckSum) data or Headers. Must match target setting.
#
DataDigest=False
HeaderDigest=False
## Account Login information
# . The AuthMethod values are: None,CHAP, and (TwoWay) MutualCHAP,
#
AuthMethod=None
CHAPUsername=iqn.1991-05.com.microsoft:comfort.txn.cpqcorp.net
CHAPSecret=Some12day123
CHAPMSecret=BetterThanThat
```

2. Write the boot path to the target server. The boot path configuration file may be written to the target server with the ev DOS utility or written using the ibootcfg utility.
    a. To write the boot path using the ev DOS utility, boot to DOS and change directories to the ev DOS utility. The ev DOS utility is packaged with the HP iSCSI boot feature.
    b. Execute the following on the server with the option ROM.

        ```
        ev -c <evinput.txt
        ```

For more information on configuring the HP ProLiant Gigabit Ethernet Multifunction server adapter, see the HP ProLiant iSCSI Boot for Linux User Guide.

Installing the operating systems

Root partition on SAN has become popular with blade systems and virtualization technologies. Multipath feature support for operating system installation partitions was introduced with the latest operating system distributions. OS vendors have provided the feature for enabling high availability for the installation partitions on the SAN.

To enable the high availability feature in RHEL and SLES operating system, complete the following steps:

Enabling the Device Mapper multipath feature

Recommended configuration on RHEL operating system

Ensure that there are multiple paths to the LUNS before starting the installation process. If there is only one path to the LUNS, Anaconda installs the operating system on the SCSI device even if mpath is specified as a kernel parameter. Enabling multipath features for the installation partitions on iSCSI SAN devices is supported in RHEL 5.3 and later.

1. Start the installation of the operating system.
2. Provide the parameter "linux mpath" to the kernel boot line.

RED HAT
ENTERPRISE LINUX 5
- To install or upgrade in graphical mode, press the <ENTER> key.
- To install or upgrade in text mode, type: linux text <ENTER>.
- Use the function keys listed below for more information.
[F1-Main] [F2-Options] [F3-General] [F4-Kernel] [F5-Rescue]
boot: linux mpath_

Figure 27

3. To add the iSCSI devices to the installation, complete the following steps, else go to Step 4:
   a. Click **Advanced storage configuration**.

RED HAT
ENTERPRISE LINUX 5
Installation requires partitioning of your hard drive.
By default, a partitioning layout is chosen which is
reasonable for most users. You can either choose
to use this or create your own.
Remove linux partitions on selected drives and create default layout.
Select the drive(s) to use for this installation.
Advanced storage configuration
Review and modify partitioning layout
Release Notes
Back
Next

Figure 28

b. Select Add iSCSI targets and click **Add drive**.

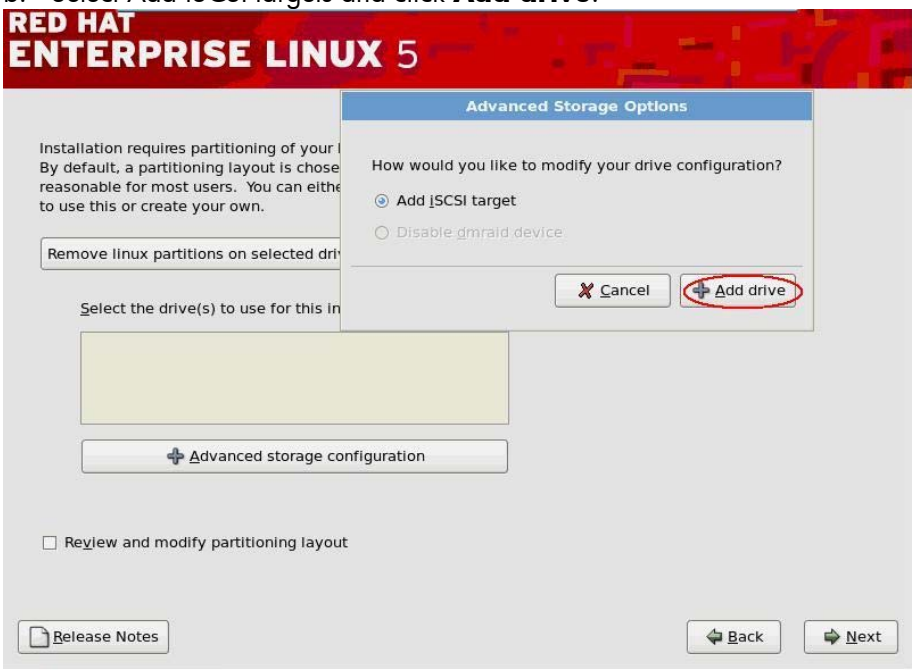

Figure 29

c. Enable network Interface for the currently used NIC.

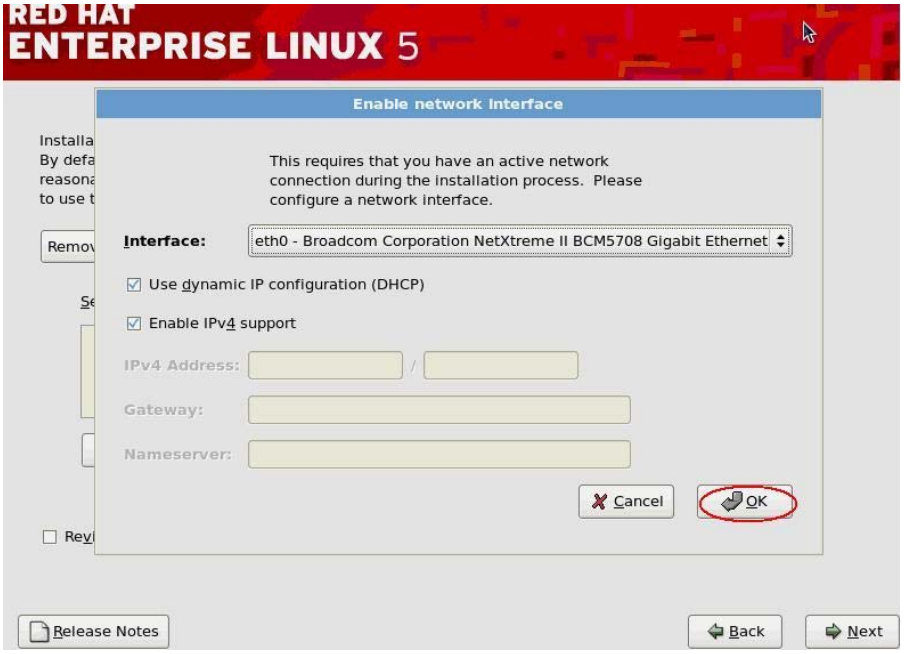

Figure 30

d. Enter the target IP address.

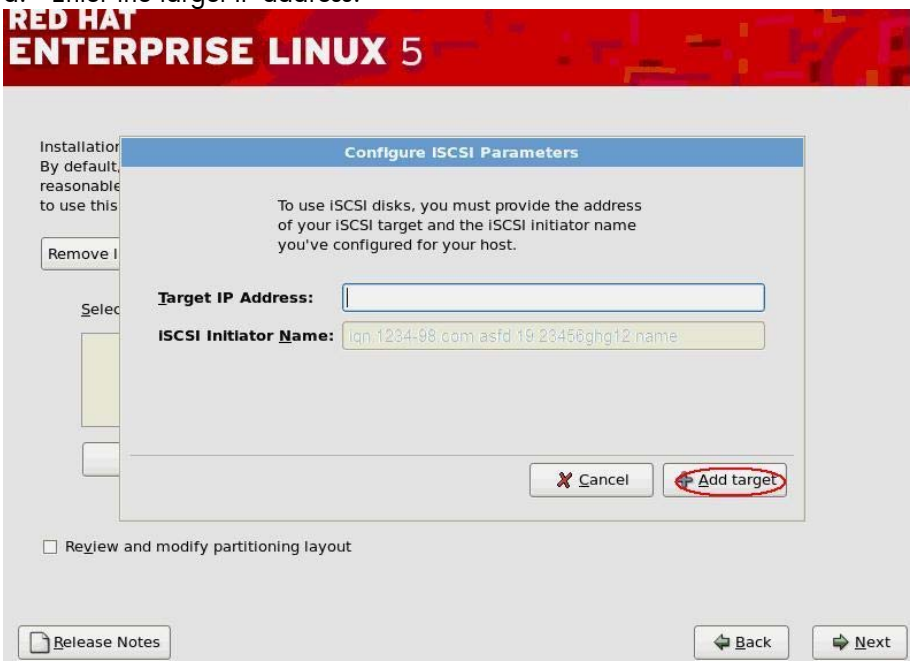

Figure 31

e. Repeat step a to d to add more iSCSI targets.

4. While creating partitions during the installation process, you will see multipath devices (/dev/mapper/mpath*). Create the installation partitions using multipath devices. Multipathing feature will be enabled for all the operating system partitions created on multipath device during installation.

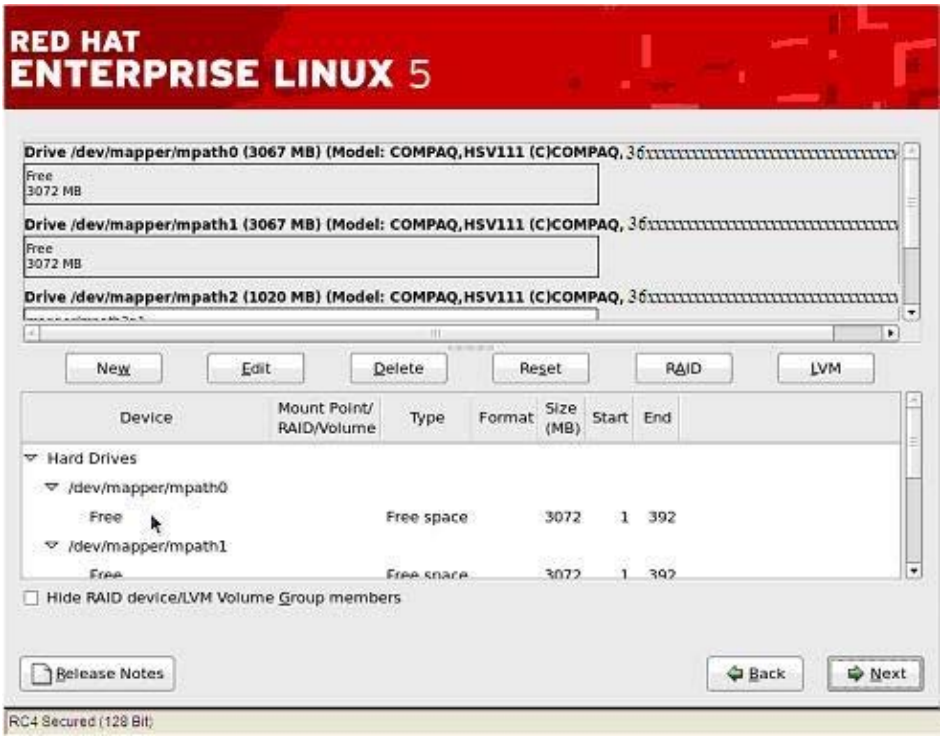

Figure 32

5. Ensure that iscsi-initiator-utils and device-mapper-multipath packages are selected in the package list.

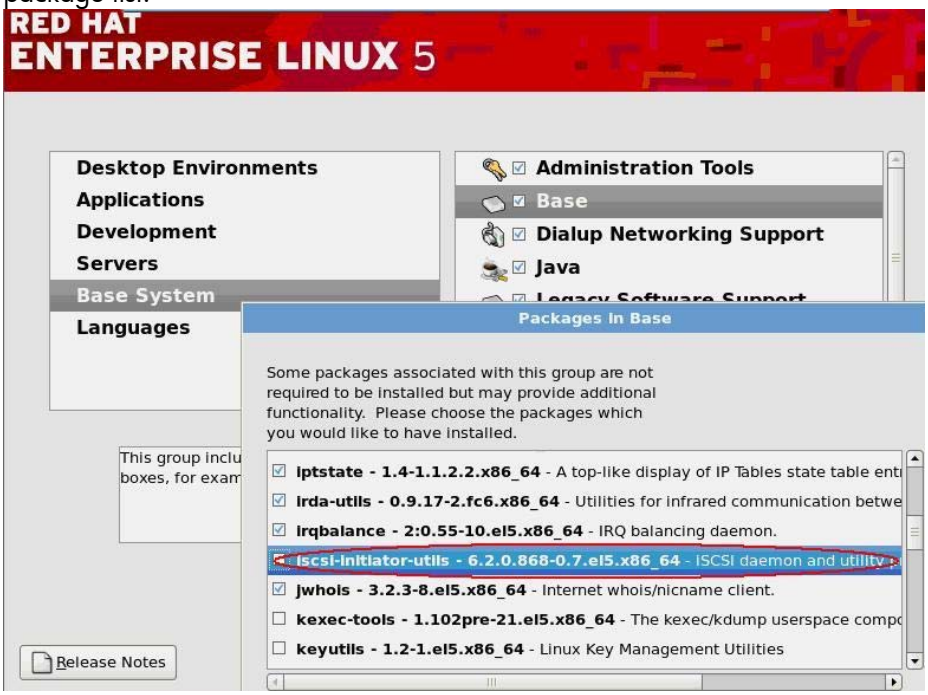
RED HAT
ENTERPRISE LINUX 5
Desktop Environments
Applications
Development
Servers
Base System
Languages
Administration Tools
Base
Dialup Networking Support
Java
Packages In Base
Some packages associated with this group are not required to be installed but may provide additional functionality. Please choose the packages which you would like to have installed.
This group inclu
boxes, for exam
iptstate - 1.4-1.1.2.2.x86_64 - A top-like display of IP Tables state table enti
irda-utils - 0.9.17-2.fc6.x86_64 - Utilities for infrared communication betwe
irqbalance - 2:0.55-10.el5.x86_64 - IRQ balancing daemon.
iscsi-initiator-utils - 6.2.0.868-0.7.el5.x86_64 - iSCSI daemon and utility
jwhois - 3.2.3-8.el5.x86_64 - Internet whois/nicname client.
kexec-tools - 1.102pre-21.el5.x86_64 - The kexec/kdump userspace compo
keyutils - 1.2-1.el5.x86_64 - Linux Key Management Utilities
Release Notes

Figure 33

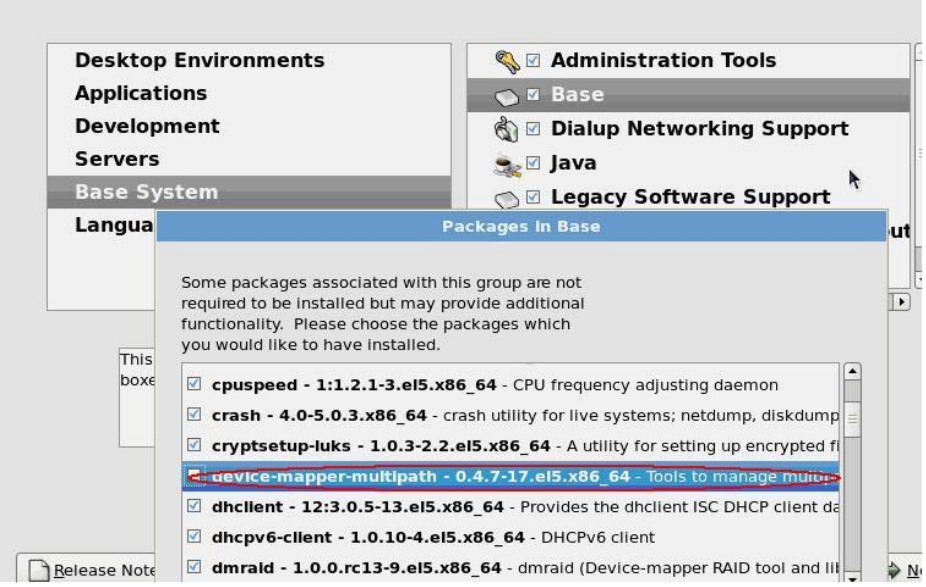
Desktop Environments
Applications
Development
Servers
Base System
Langua
Administration Tools
Base
Dialup Networking Support
Java
Legacy Software Support
Packages In Base
Some packages associated with this group are not required to be installed but may provide additional functionality. Please choose the packages which you would like to have installed.
cpuspeed - 1:1.2.1-3.el5.x86_64 - CPU frequency adjusting daemon
crash - 4.0-5.0.3.x86_64 - crash utility for live systems; netdump, diskdump
cryptsetup-luks - 1.0.3-2.2.el5.x86_64 - A utility for setting up encrypted f
device-mapper-multipath - 0.4.7-17.el5.x86_64 - Tools to manage multi
dhclient - 12:3.0.5-13.el5.x86_64 - Provides the dhclient ISC DHCP client da
dhcpv6-client - 1.0.10-4.el5.x86_64 - DHCPv6 client
dmraid - 1.0.0.rc13-9.el5.x86_64 - dmraid (Device-mapper RAID tool and li
Release Note

Figure 34

6. Complete the installation and reboot the server.

Note:

- If the installation partitions are on a XP array, comment the following line in "defaults section" in the /etc/multipath.conf file:

  prio_callout "/bin/true"

- If the installation partitions are on a MSA2xxxsa array, comment the following line in "device section" of the MSA2xxxsa array in the /etc/multipath.conf file:

  getuid_callout "/sbin/hp_scsi_id -g -u -n -s /block/%n"

Recommended configuration on SLES operating system

- It is recommended to have a single path to the logical units while installing SLES10 operating systems and multiple paths to the logical units while installing SLES11 systems.
- It is also recommended to mount the installation partitions using “by-label” fstab option.
- If you are choosing to mount the installation partitions by device-id, ensure that you set the "user_friendly_names" to "no" in /etc/multipath.conf file to avoid boot failures after rebuilding the *initrd* image.

Note: For iSCSI SAN devices in SLES10SP2, use only “by-id” fstab option to mount the installation partitions.

1. Start the installation of the operating system. For iSCSI SAN boot, complete the following step, else go to Step 3:
   a. Provide the parameters “withiscsi=1 netsetup=1” to the kernel boot line for SLES10SP2.

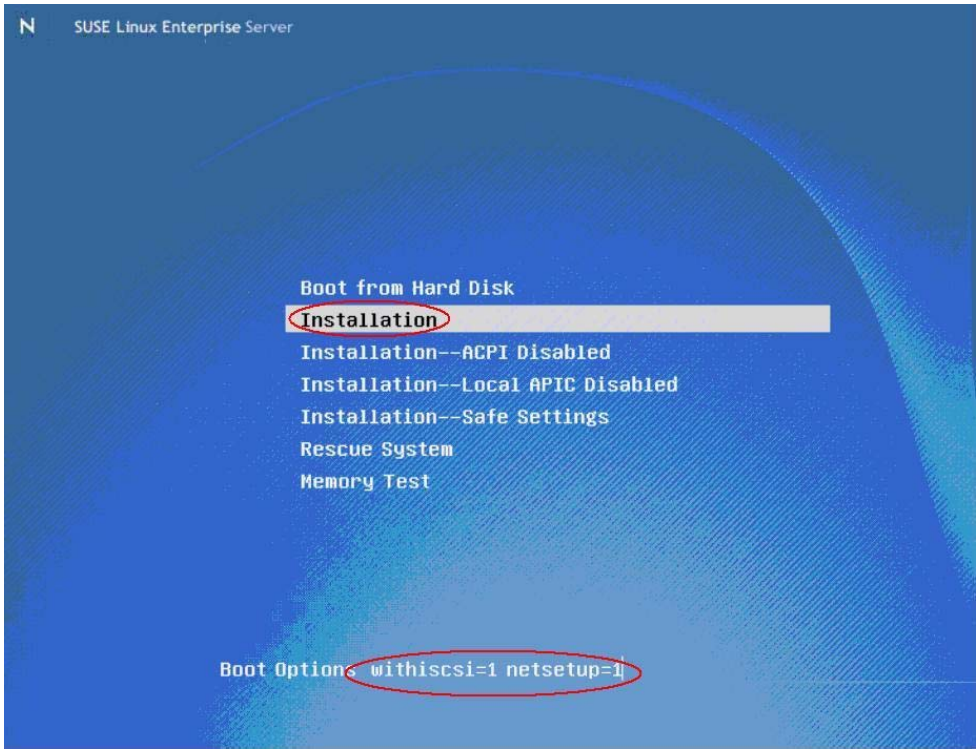

Figure 35

b. Provide the parameters "withiscsi=1" to the kernel boot line for SLES11.

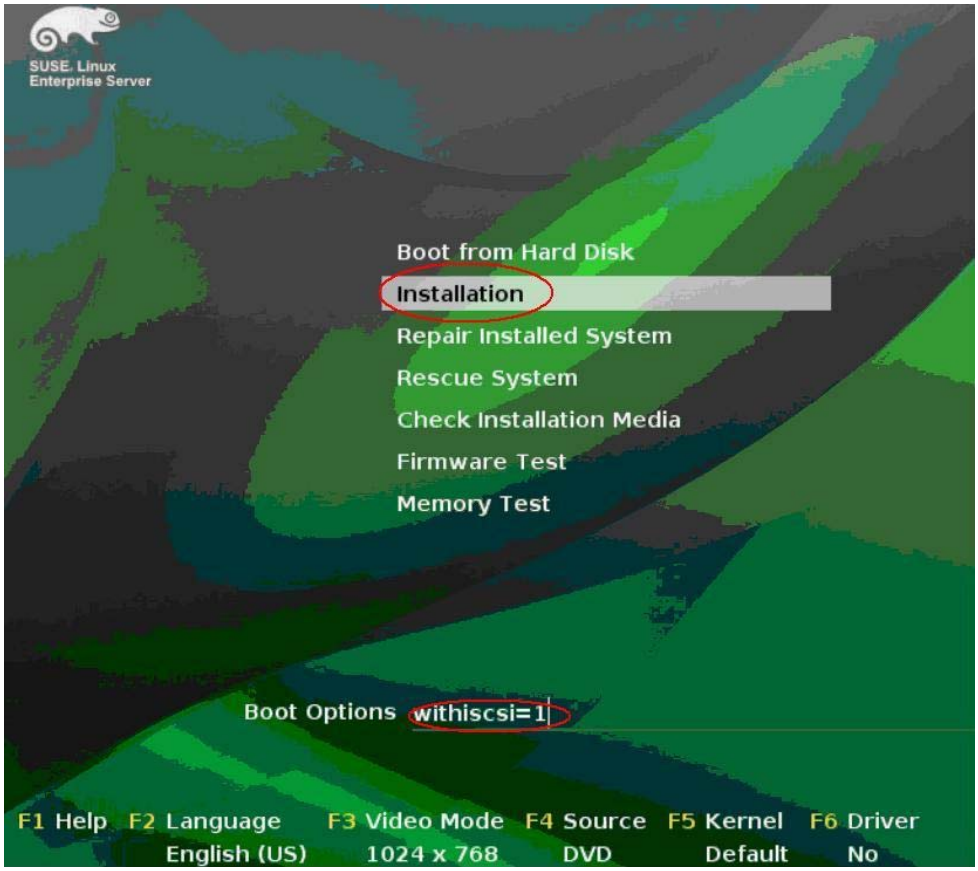

Figure 36

2. To add the iSCSI devices for installation, complete the following step, else go to Step 3:

   a. Select the currently used network device (NIC)

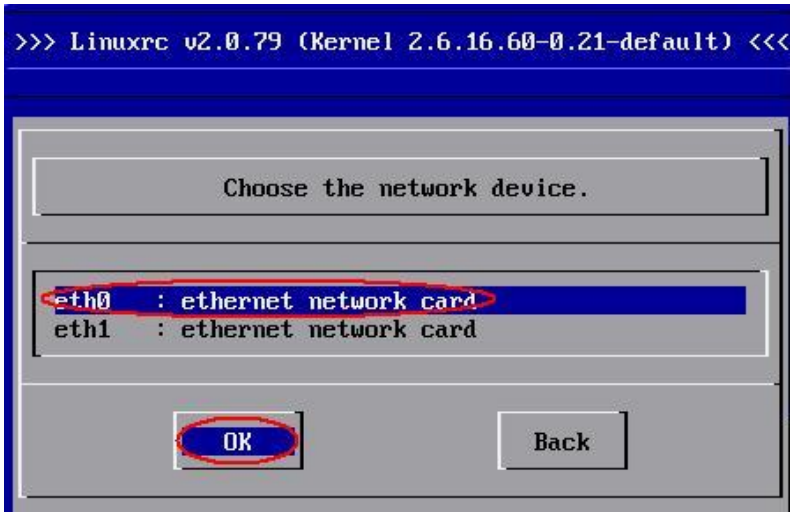

Figure 37

b. Configure the IP information.

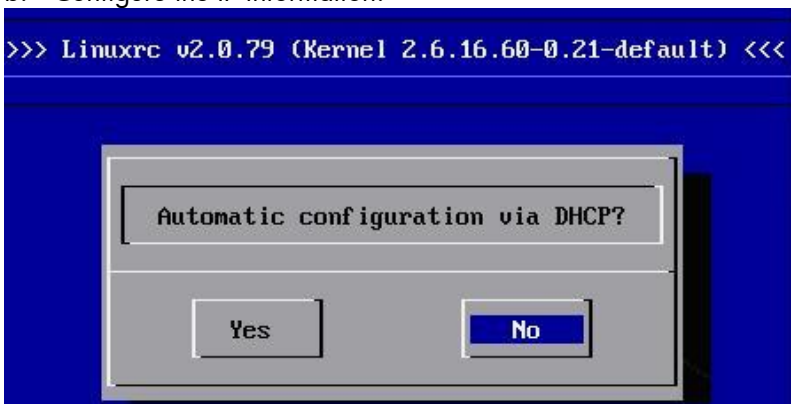

Figure 38

c. Ensure that the "Initiator Name" is correct.

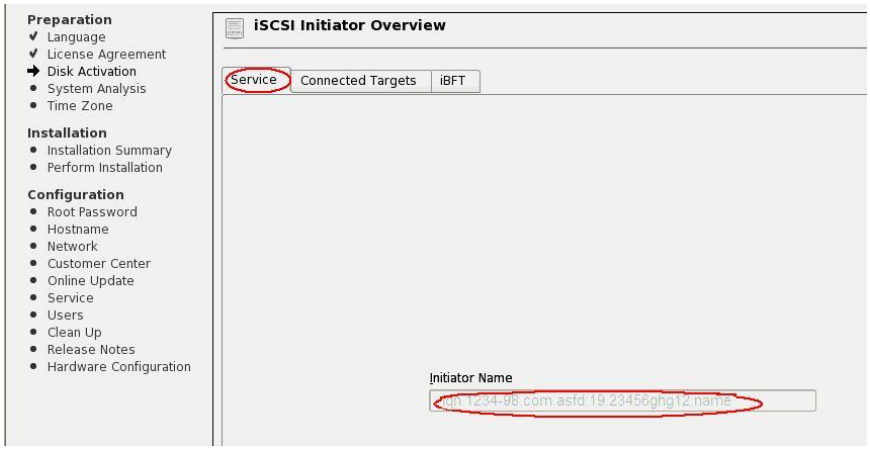

Figure 39

d. Setting up the target IP:

- For SLES10 operating systems ensure that only one target IP is connected and the Start-Up is set to automatic.

Figure 40

- For SLES11 operating systems ensure that more than one target IP set. By default only one target IP is connected. Add new target IPs using the "Add" button under the Connected Targets tab.

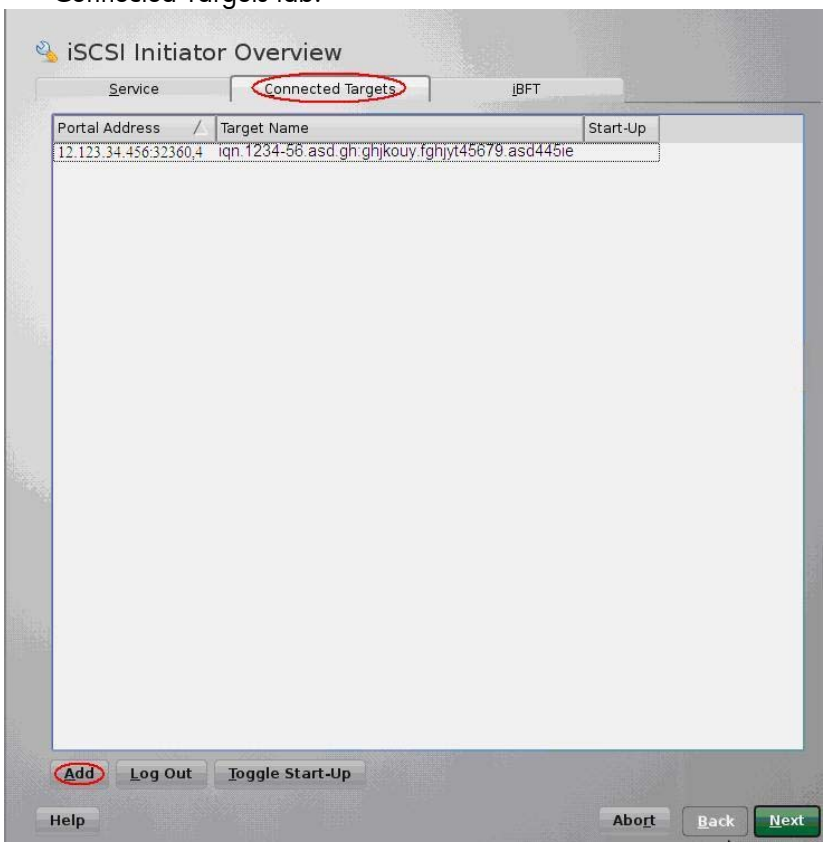

Figure 41

- Enter the Target IP address and click Next.

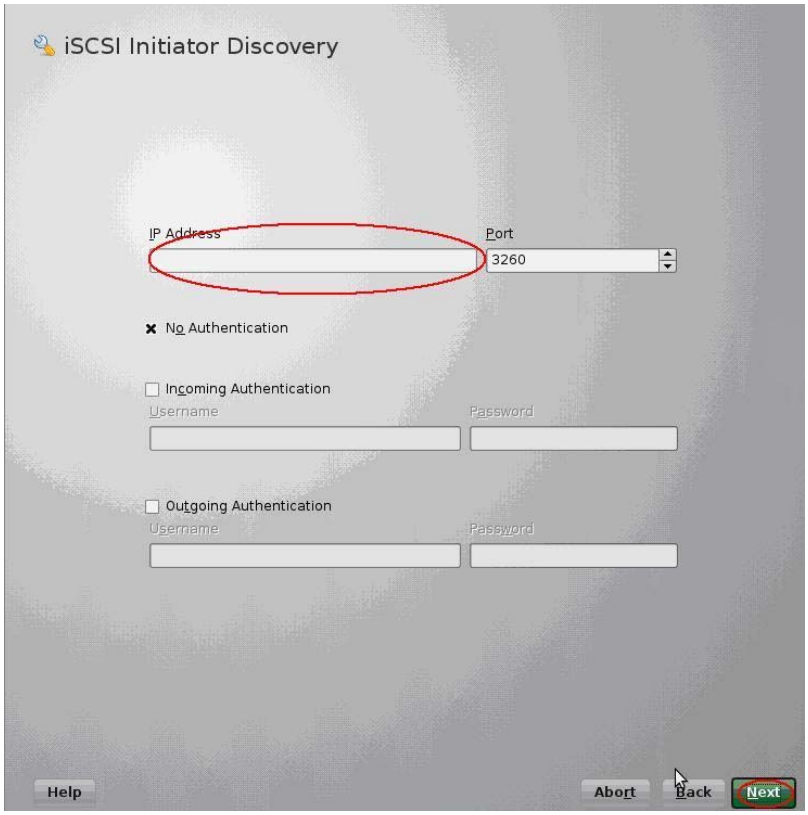

Figure 42

- Click Connect to connect to the target IP.

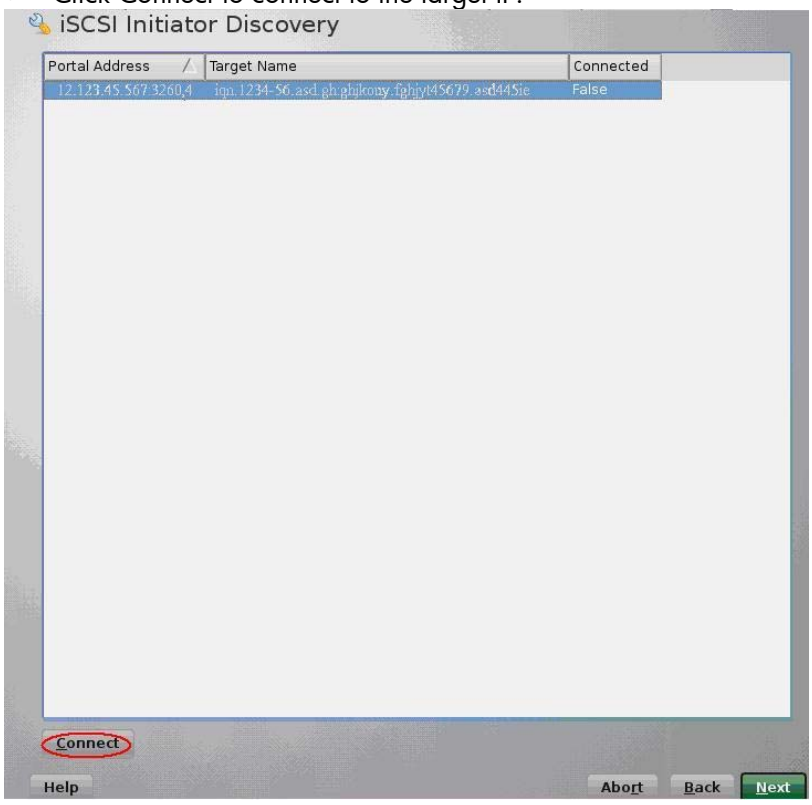

Figure 43

- Change the Start-Up to automatic by using the toggle set-up button.

3. Select the device for installing the operating system:
   - For SLES11 operating systems, complete the following steps:
     a. Select the DM devices to create installation partitions.
     b. By default, DM devices are not listed. To list the DM devices select Hard Disks.

c. Click Configure > Configure Multipath > Yes > Yes.
d. Select the DM devices to create installation partitions.

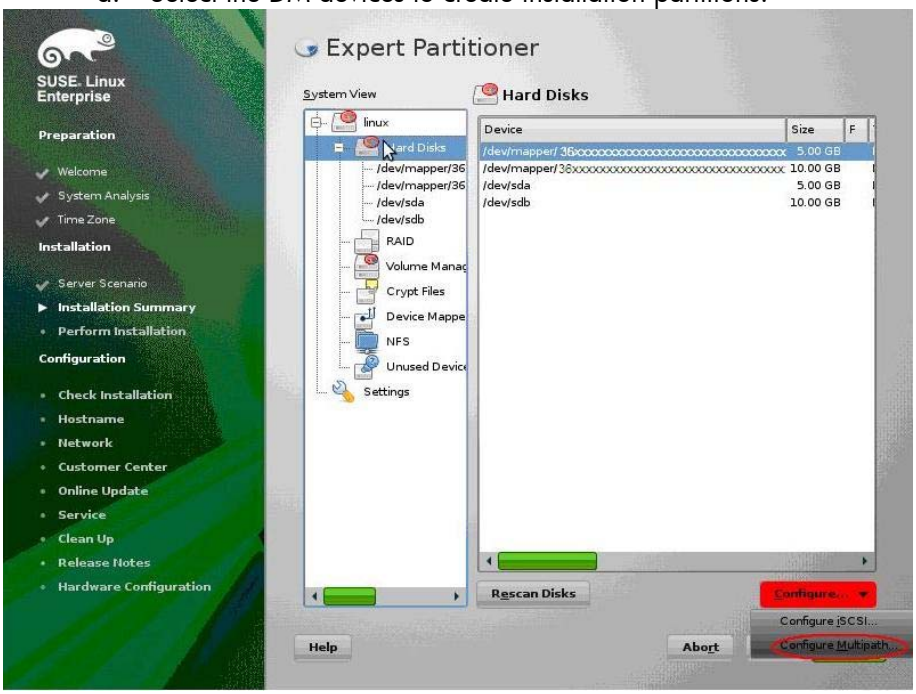

Figure 44

- For SLES10 operating systems, select SAN devices for installation partitions.

4. While creating the installation partitions, select either of the following options:
   - If you intend to use the "user_friendly_names" with device mapper multipath devices select "by-label" fstab option.
   - If you do not intend to use the "user_friendly_names" with device mapper multipath devices, select "by device-id" fstab option.

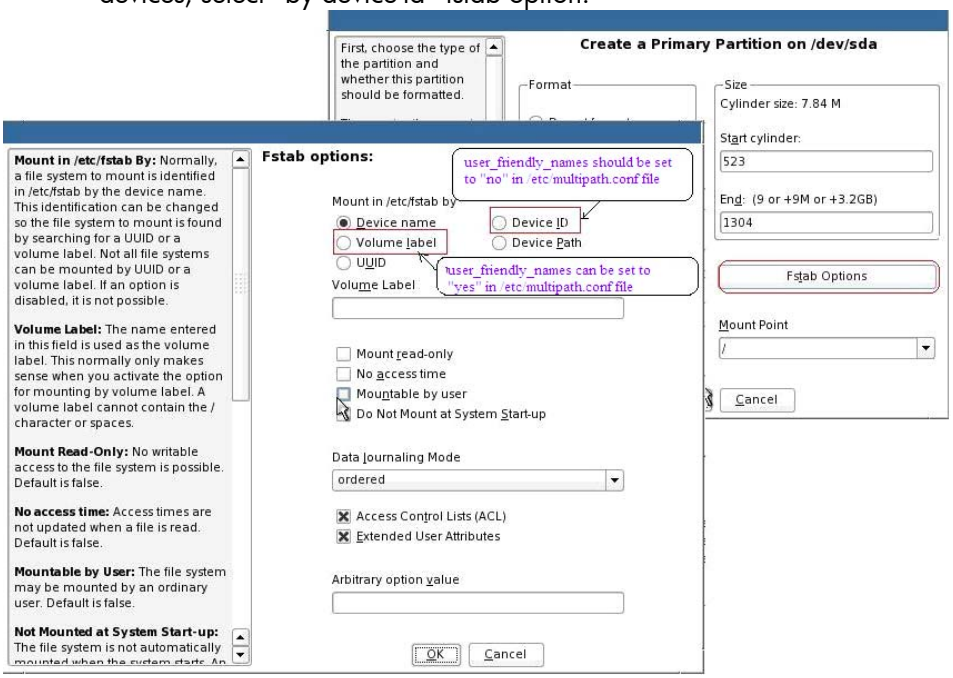
Create a Primary Partition on /dev/sda
First, choose the type of the partition and whether this partition should be formatted.
Format
Size
Cylinder size: 7.84 M
Start cylinder:
523
End: (9 or +9M or +3.2GB)
1304
Fstab Options
Mount Point
/
Cancel
Fstab options:
user_friendly_names should be set to "no" in /etc/multipath.conf file
Mount in /etc/fstab by
Device name
Volume label
UUID
Device ID
Device Path
user_friendly_names can be set to "yes" in /etc/multipath.conf file
Volume Label
Mount read-only
No access time
Mountable by user
Do Not Mount at System Start-up
Data Journaling Mode
ordered
Access Control Lists (ACL)
Extended User Attributes
Arbitrary option value
OK
Cancel
Mount in /etc/fstab By: Normally, a file system to mount is identified in /etc/fstab by the device name. This identification can be changed so the file system to mount is found by searching for a UUID or a volume label. Not all file systems can be mounted by UUID or a volume label. If an option is disabled, it is not possible.
Volume Label: The name entered in this field is used as the volume label. This normally only makes sense when you activate the option for mounting by volume label. A volume label cannot contain the / character or spaces.
Mount Read-Only: No writable access to the file system is possible. Default is false.
No access time: Access times are not updated when a file is read. Default is false.
Mountable by User: The file system may be mounted by an ordinary user. Default is false.
Not Mounted at System Start-up: The file system is not automatically

Figure 45

5. Complete the installation and reboot.
6. Ensure that the latest supported Device mapper multipath tools package is installed.
7. If you have chosen to mount the installation partitions by device-id, ensure that you set the "user_friendly_names" to "no" in /etc/multipath.conf file.
8. For boot volumes mounted using "by-id" fstab options, configured on Smart Array Controllers, perform the following steps, else go to Step 9.

- Modify "root=/dev/disk/by-id/cciss-3xxxxxxxxxxxxxxxxxxxxx" to "root=/dev/disk/by-id/scsi-3xxxxxxxxxxxxxxxxxxxxx" in /boot/grub/menu.lst.
- Modify "/dev/disk/by-id/cciss-3xxxxxxxxxxxxxxxxxxxxx" to "/dev/disk/by-id/scsi-3xxxxxxxxxxxxxxxxxxxxx" in /etc/fstab.

9. Enable multipath services to start at boot time by running the following commands:
   ~foo# chkconfig boot.multipath on
   ~foo# chkconfig multipathd on
10. Add device mapper multipath kernel module to initrd image by completing the following steps:
    a. Edit the file /etc/sysconfig/kernel and add "dm-multipath" to "INITRD_MODULES"
    b. Create a new initrd image, which include device mapper kernel modules
       ~foo#mkinitrd -k <kernal> —i <initrd>
    c. Edit the value for default parameter in /boot/grub/menu.lst file to boot with the new initrd image.
11. Reboot the server.

Additional Information

For detailed information about HBAs, switches, storage arrays, and storage software, go to the following websites:

Table 1

Topic	HP website
HBAs and switches	http://h18006.www1.hp.com/storage/saninfrastructure.html
Storage array systems	http://h18006.www1.hp.com/storage/arraysystems.html
Device Mapper Multipath software	http://www.hp.com/go/devicemapper
Integrity servers	http://www.hp.com/products1/servers/integrity/

To make comments and suggestions about this document, please send a message to multipathfeedback@hp.com.

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5697-0067, July 2009

invent